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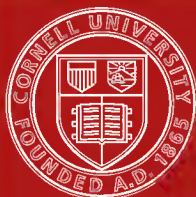
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**PROVINCIAL AND DISTRICT**

**NOTES**

ON THE

**Agricultural Conditions and Problems**

OF THE

**UNITED PROVINCES**

BY

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DISTRICT NOTES OF SHAHJAHANPUR.





## PROVINCIAL NOTE.

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I HAVE attempted to make the district notes complete in themselves as regards all the more important subjects on which information is available, but they would become inconveniently long if they were to include discussions of every point that has arisen in connection with a number of districts. I have therefore put together the following note for the province as a whole, as supplementary to the district notes, and as indicating the need for investigation of particular matters concerning more than one district.

### I.—Masonry wells.

It will be convenient to bring together the results of the enquiries made regarding the possibility of increasing the number of masonry wells.

(a) Almost every district where spring wells are practicable has room for many more than exist.

(b) Where the practice of sinking wells is established, the local knowledge as to the presence of a stratum of foundation-clay can usually be relied on: elsewhere facilities should be provided for trial-borings.

(c) Where foundation-clay is believed by the people to be absent, it is worth while to arrange for borings to determine whether it exists at a depth greater than has been explored. If it is found, "semi-artesian" wells of the type described in the Manual of Irrigation Wells can be constructed. If there is no foundation-clay within reach, only percolation-wells can be constructed.

(d) There are extensive tracts, especially in the north-east of the province, where masonry percolation-wells are fairly efficient, though they cannot as a rule yield the same supply as spring-wells and therefore protect a smaller area, besides being more liable to failure.

## *Masonry wells.*

It is not possible at present to make definite recommendations regarding the construction of such wells in places where the people now rely on temporary wells: the question of cost and advantages must be worked out in accordance with the local conditions; but it may be suggested that as the cost of labour rises the introduction of masonry linings will tend to become advantageous. Should the agricultural department succeed in devising a form of percolation-well which can be constructed at moderate cost, without specialised skill, and of materials available in the villages, the whole position will be altered, and it will be desirable to arrange for the construction of demonstration-wells of the approved type in all the principal tracts that at present rely on percolation supplies.

(e) Where masonry spring-wells are possible and are still required, the most important point is to bring home to the people that Government is anxious to see the wells made and is prepared to find the capital that is needed. Considerable progress has been made in this direction in recent years, but steady effort and constant repetition are required to make the people realise the position.

(f) Apart from the supply of capital, perhaps the most important factor is the attitude of the landholders, which varies within very wide limits. On the one hand there is the landholder who takes active measures to secure that wells are made wherever they are wanted, either constructing them at his own cost, or making the tenants construct them and assisting with the loan of capital and the supply of wood for fuel. This class is represented by not a few of the large landholders as well as by the Court of Wards. At the other extreme are the landholders—happily few—who object to seeing a tenant sink a well and who will not sink wells themselves. The majority of the landholders come between these extremes: some are benevolent but inactive, some neutral, and some inclined to raise obstacles; and the district administration can do much in the way of influencing the individual members

### *Masonry wells.*

of this large intermediate class. The information collected shows that the attitude of landholders has on the whole improved during the last five years, but here again steady pressure and constant repetition are required to secure the object of Government, that wells should be made wherever they are wanted.

(g) An obstacle very commonly interposed in Oudh is the practice of requiring a tenant to relinquish his claim to compensation on ejection as a condition of the grant of permission. Such a condition necessarily discourages construction: many wells are made under it by tenants who trust their landholder, but many more would be made if the condition were not imposed. The extent of the practice may be judged from the fact that the Board of Revenue has found it necessary to prohibit its adoption in particular cases in estates that have come under the Court of Wards; that is to say the local authorities have regarded it as a normal feature of estate-management. It is probable that the tenants' relinquishment would be held by the courts to be inoperative, but such a decision if given would not be of widespread application since the landholder's consent is rarely given in writing and proof of written consent is necessary to establish a claim to compensation. The provisions regarding improvements will doubtless be reconsidered when the question of amending the Rent Act arises.

(h) The supply of water in spring-wells is not always adequate. In some cases this defect is remediable, and the supply has been greatly improved in a large majority of the attempts by sinking a pipe through the bottom of the well to a spring underlying a lower stratum of clay.

In other cases the deficiency is due to the stratum of foundation-clay being too thick to be pierced by the tools at the cultivator's disposal. In these two cases, facilities for boring should be provided.

## *Field-embankments.*

(i) It is probable that in many cases existing wells could yield a much larger supply of water than can be obtained from them by the methods now used : and that with improved methods of raising water the diameter of new wells, and therefore the cost of construction, could be very greatly reduced. The adaptation of power-pumping to the conditions should therefore be regarded as one of the most urgent problems before the agricultural department.

(j) A problem of lesser urgency, but one which should be worked out, is the most economical methods of distributing the water raised. A very large proportion of the water is lost by evaporation and percolation while passing along the earthen channels on its way to the field, and it is quite possible that with a continued rise in cost of labour and cattle-power it will be found economical to adopt some form of piping or lining, at least for the longer channels and in the more porous soils. Even now channels lined with roof-tiles may occasionally be seen ; and though the capital cost of regular piping is probably prohibitive, it may be possible to design forms that can be made by the village artisans.

### **II.—Field-embankments.**

The need for field-embankments arises where a soil naturally retentive of moisture but not easily irrigible lies on such a slope that much of the rain water runs off the surface. When the rains cease early such land will be unfit for rabi cultivation, though it would often be perfectly fit if it had been allowed to absorb a larger proportion of the rain that had fallen. An embankment across the slope effects this object : and where irrigation is not feasible it is the only means of protection that can be suggested. An additional advantage is that the surface of the land so embanked is protected from the scour of running water which removes portions of the fertile soil ; while when the practice is systematically adopted, the development of ravines in the lower slopes will probably be checked.

### *Field-embankments.*

The construction of small embankments of this kind is best effected by the people : Government assistance is required (1) in providing capital, (2) sometimes in laying out the work with due regard to levels, (3) in constructing demonstration-embankments in localities where the people are unacquainted with the practice. In addition, a certain amount of pressure is required to contract the tendency of the people to put off such enterprises till a dry season comes : recent experience is to the effect that embankments are readily made during and just after a famine, but that the impetus dies down when times of prosperity recur. For the larger embankments some skilled supervision is desirable to prevent work being wasted.

The chief scope for these works is in the black soil tracts of the Jhansi division and the Allahabad district : in all of these districts considerable progress has been made in recent years but there is still room for very many more embankments. It is probable, though the question has not been fully studied, that such works would prove of great value in the unirrigated tracts of mixed soil along the Jumna and Ganges, and it is desirable that these tracts should be examined by an officer familiar with Bundelkhand practice, and that a few demonstration-embankments should be constructed by Government in each tract found suitable.

The tracts that might be examined are—

- Agra ... Tahsil Bah.
- Etawah ... The *ghar* and Jumnapár tracts.
- Cawnpore ... The Jumna tract. (The Collector has recently pressed for the construction of a few embankments here.)
- Fatehpur ... The Jumna tract.
- Allahabad ... Pargana Atharban,
- Benares ... The Karail soil tracts in Chandauli tahsil,
- Ghazipur ... The Karail soil tracts south of the Ganges,

### III.—Embankments for late rice.

Where canal water cannot be made available, the only hope of saving any part of the late rice when the rains cease prematurely lies in embankments across the drainage lines; and such works are useful in all but the wettest seasons in affording supplies for a final irrigation to the crop in their vicinity, and sometimes in enabling a rabi crop to be sown after the rice is harvested. Their value is recognised by the people, and large numbers are in existence. The question whether they can be increased in number and improved in design does not appear to have been studied, and it is suggested that this question should be taken up, and the conditions of one or two of the most important tracts examined in detail to see if extensions or improvements are possible and to propose measures for carrying out such works as are desirable. The tract including pargana Ungli in Jaunpur and a large portion of Deogaon tahsil in Azamgarh would be specially suitable for such an investigation; it is exposed to the risk of severe distress when the late rice is lost. Experience gained in the study of one such tract could then be applied to the others: the districts chiefly concerned are Fatehpur, Allahabad, Benares, Mirzapur, Jaunpur, Ghazipur, Ballia, Azamgarh, Rae Bareli, Fyzabad, Sultanpur and Partabgarh.

The area of late rice is important also in Gorakhpur, Basti, Kheri, Gonda and Bahraich, but the conditions are somewhat different and conclusions could not be applied so directly in these districts as is the case south of the Gogra. In some of them embankments will probably be found suitable, while in others the utilisation of streams is a more likely method of protection.

### IV.—Drainage.

THERE is comparatively little of general interest to be said under this head. The country served by canals is looked after by the Irrigation department, the jurisdiction of which

## Drainage.

is extending as new irrigation projects are carried out; and beyond their jurisdiction little fresh light has been thrown on requirements during the recent series of dry seasons.

Broadly speaking, the natural drainage of the Ganges-Gogra doab is unsatisfactory. Only a very small portion of this area drains direct into those rivers: the main drainage-lines, the Gumti, Sai, Tons, &c., are unable to carry off all the surface-water that reaches them after heavy falls, and cannot take largely increased supplies and in the intervening stretches of heavy clay the surface-water collects in the *jhils*, and either evaporates or is used for irrigation. After wet seasons a demand for the drainage of these tracts usually arises, but it is never unanimous, and it dies away when dry seasons recur. At the present time any proposals for drainage would probably be most unpopular: but in the event of canal-irrigation being introduced into this doab, the question of drainage will require the most careful consideration, and free use should be made of any available district records regarding the position in the years 1893 to 1895, when the area covered by water reached a maximum.

Some of the larger light-soil tracts, notably the Rohilkhand *bhur* and the land along the Kali Nadi in Etah and Farrukhabad, present exactly opposite conditions.

In them an unusually large proportion of the rainfall sinks into the ground, instead of flowing off or collecting in surface depressions, and experience indicates that the subterranean movement of water towards the drainage-lines proceeds very slowly. A series of wet years tends to raise the water-level in such tracts to a point that prevents profitable cultivation, and deterioration may be exceedingly rapid: while on the other hand the retention of such rain as falls gives these soils unexpected resisting power in dry seasons. The Kali Nadi tract is under the observation of the Irrigation department, and drainage-works have been carried out, but it cannot

## Drainage.

be said that they have been fully tested by a series of wet seasons. In the event of surface-water in any part of the Rohilkhand *bhur* being increased by the construction of the Sarda-Ganges canal, very careful attention should be given to this tract, or there is a distinct danger that the experience of the Kali Nadi tract may be repeated. Even if the canal is not made, it is most desirable to maintain regular observations of the water-level in wells at intervals along the tract, and when a distinct rise is observed to be in progress to clear out the interrupted drainage-lines which exist below the *bhur* and thus facilitate escape of the water; the clearing of these lines is probably not desirable while the water-level stands low.

In the remainder of Rohilkhand and Oudh and in Gorakhpur, such injury as occurs from excessive water is usually due to floods in the river-valleys, and must in existing circumstances be regarded as inevitable.

Practically the whole doab is in charge of the Irrigation department, and the only portion known to require attention is the centre of the Fatehpur district and the adjoining portion of Allahabad: the position is stated in the district notes.

In most of the country south of the Jumna-Ganges line the problem is to check rather than facilitate the movement of water. There are exceptions to this last statement; some of them are very local, but the question of controlling floods caused by the spill of rivers is of rather wider interest. Works have recently been carried out to control the spill from the Utangan in the Agra district, and it is desirable to see whether similar action can be taken in regard to the Karamnasa and Gorai rivers which periodically send out floods across portions of Benares and Ghazipur.

## V.—Ravines.

The gradual loss of fertile land caused by the extension of ravines is in the aggregate serious: the fact that the loss is gradual enables the population affected to adapt itself



## *Ravines.*

to the changed conditions, but the evil is of sufficient general importance to justify continued efforts both to utilise the land already ravined and to prevent or minimise further extensions.

To minimise extensions the essential is to reduce to the lowest possible amount the run-off from the land lying above the ravines and drainage into them. This result is attained by the field-embankments of Bundelkhand (vide section II), and their continued construction is most desirable on these grounds alone. In the rest of the provinces the land just above the ravines is as a rule unirrigable, and in accordance with the custom of the country is sown with kharif crops rather than with rabi. Naturally when the rainfall is heavy, either the field boundaries break, or the cultivators cut them to save their crops, and most of the flood passes direct into the ravines; a large proportion of the extensions are thus directly traceable to the effects of sudden heavy rainfall. It is highly probable that if the border-fields were sufficiently embanked to retain the moisture and left uncropped during the rains, they could be used for rabi crops even without irrigation: but it is at least doubtful if the rabi yield so obtained would be greater than the kharif that would be sacrificed, and very doubtful if it would pay for the cost of embanking. Experiments on this point are however desirable.

An alternative method of reducing run-off is to use the land above the ravines as a fuel and fodder reserve, and there is a reasonable prospect that this will pay the landholder provided he is within reach of a market for *babul* bark, and provided he can wait for a cash return until the period when the first crop of *babul* matures.

A small experiment on these lines has been initiated by the agricultural department, and it is understood that the forest department is about to undertake further experiments. Should it be found that the practice is financially sound, the question of encouraging its extension will have to be

## *Ravines.*

considered. The ordinary landholder will not easily realise the advantages : on the one side he has an increase of grass, which may bring a small annual income, and a prospect of a lump sum in perhaps ten years' time for bark and wood (unless he lets his tenants have the wood and sets free an equivalent amount of manure): on the other hand he loses the rental of the land, and may have trouble in getting it out of the tenants' hands. The points to be considered by Government will be largely questions of land revenue : should the revenue of land so used be remitted, and if so should a charge be levied when the crop of wood and bark is sold : or are the advantages to the country—more fodder, more fuel, more manure, and less extension of ravines so great as to justify remission of all revenue so long as the reserve is maintained ?

Wherever a reserve is established, efforts should be made to extend it as far as possible into the ravine-system : sites may often be found at the head of a ravine where when most of the run-off has been arrested by the reserve—small earthen dams can be made and grass and trees established, and a gradual extension downwards may be found possible as more and more water is arrested at and near the head. This course appears in present circumstances to be the only feasible method of utilising the ravines already in existence ; the alternative of dams to collect the silt is so far as can be judged financially unprofitable because so long as the ravines receive the run-off from the upland every dam must have a masonry escape and the aggregate cost of these works would be very great.

## **VI.—Insect-pests.**

The study of the insect-pests of the province is still incomplete, but it has progressed sufficiently far to show that as a rule there is little scope for individual action when the pests have developed, but that they can in many cases be controlled by associated action taken at the right season.

## *Insect-pests.*

The following notes deal only with the pests which have been prominent in recent years and regarding which information is available. When other pests are reported, the facts should be communicated *without delay* to the department of agriculture.

1. *The cane hopper.*—This pest has caused serious loss in recent years throughout several of the eastern districts and in South Oudh ; its most usual vernacular name is *Phangi*. It resembles a grasshopper, and appears on the sugarcane early in the rains, feeding on the leaves during July and August : when it has attacked a field in numbers the resulting injury is very serious. Practically nothing can be done when the hoppers have once entered the cane-field.

They can be caught just after birth when they usually feed for a few days in the rice-nurseries or on kharif crops that have just come up : this can be done by sweeping a bag over the place where they are feeding, and the insects caught in the bag should be thrown into a vessel containing kerosine oil and water. But a much more effective remedy is to destroy the eggs, and this can be done at any time between February and the break of the rains by turning over the soil of the fields where sugarcane has been grown ; this action exposes the eggs, which are lying dormant just under the surface of the soil, and the heat of the sun will then kill them. The soil can be turned over either by a soil-inverting plough or by digging it.

To secure success it is necessary that the practice shall be adopted over all the cane-fields of the affected area, and pressure may have to be exercised on the landholders to see that this is done.

In parts of Bara Banki, and probably elsewhere, it is already the practice to dig the land daily as the sugarcane is removed from it and before the soil has hardened : this practice almost obviates the possibility of hoppers appearing in large numbers.

## *Insect-pests.*

*Boring-insects.*—The commonest of these is the *Moth-borer* (known in vernacular as *Ar* or *Dhola*, and probably by other local names). This moth lays eggs on the leaves of sugarcane, maize and *juar*, and the young caterpillars bore their way into the stem of the plant and live there till they turn into moths: the result of their presence is the death of the stem in which they exist. Something can be done to diminish their numbers if cultivators will cut out *and burn* any stems of these plants which show signs of being attacked, but the most effective measure is to burn all the roots and stubble of maize, cane and *juar* fields before the warm weather sets in. If this is done the caterpillars which are wintering in the roots and stubbles will be destroyed, and there will be comparatively few moths in the next season. In this case too associated action is required to effect a material improvement.

*Bollworms.*—These insects do considerable damage to the cotton crop, in all probability much more than has hitherto been reported. The moth lays its eggs on the young cotton plants, and the caterpillars bore first into the plant, then into the buds and finally into the bolls. The shoots and buds attacked wither, while the lint in the bolls is spoilt. The caterpillars are less than an inch long when full grown: when they have fed sufficiently they leave the boll and make a grey cocoon attached to it on the outside.

To control this pest associated action is required from all growers in the area affected: the best measures are—

- (a) From July onwards any young plants that wither should be collected and burnt.
- (b) When picking cotton all affected bolls should be collected and burnt at once.
- (c) The plants should be cut down and used as fuel as soon as picking is over, and if possible the fields should be ploughed and levelled: if ploughing is not possible grazing cattle should be brought on to the field as much as possible.

### *Insect-pests.*

(d) The *bhindi* crop should not be grown between March and September in areas where cotton is important, because the insect will live on *bhindi* plants while cotton is not available.

The insect is probably known by a large number of local names; but the only name in general use is the word *kira* (worm).

*Aphis* (Mahun).—This small green insect appears on the rapeseed crop in enormous numbers during damp and cloudy weather: it settles on the young flower-shoots and feeds on the juice of their stems, with the result that flowers do not form or if they form give very few seeds. It can be controlled by spraying, but this method is not economically possible where the crop is grown in lines or borders; it could be carried out by societies or associations in the northern districts where rape or mustard is grown as a pure crop.

*Potato-moth*.—This moth lays eggs on the tubers, and the larvae bore into these when the potatoes are stored, and also into the plants in the field, but the injury in store is more extensive. The most important point is to see that the seed-potatoes used do not harbour the pests, and every effort should be made to prevent growers obtaining seed from localities where the pest exists. At present large parts of Bengal and notably Patna are infected, and in these provinces Lucknow and Cawnpore; but districts where the crop is important should obtain regular information from the agricultural department as to what markets are safe and should publish this information among growers when they are beginning to make their arrangements for seed.

When the presence of the moth is reported in any locality, application should be made at once to the agricultural department, which will show the growers the special precautions that should be taken to preserve seed potatoes. No vernacular name of this pest is yet established. *Rice sapper* (*gandhi*, and other local names). This is an

## *Weeds.*

evil-smelling fly that sucks the juice from the flower-shoots. It can be controlled by careful cultivation and removal of weeds from the field boundaries, but this may be impracticable: no remedy can be applied when once it has appeared in numbers. Its existence is a serious obstacle to the introduction of rice in tracts where the crop has not been recently grown, as the few experimental or demonstration plots are likely to be injured so severely that the crop will not be sown again.

### **VII.—Fungoid diseases.**

These are still imperfectly known, and prophylactic measures can consequently be recommended only in a few cases.

Smut on juar, and also on oats, can be largely prevented if the seed used is treated by the methods recommended by the agricultural department.

Rust on wheat and linseed cannot apparently be prevented, and the only course is to grow varieties which are relatively immune: suitable varieties have still to be found.

Red rot on sugarcane is not common but is disastrous where it appears. So far as is known, the only course is to abandon the variety attacked, and grow one that is relatively immune.

It is most important that the occurrence of any other fungoid disease should be promptly reported to the agricultural department in order that steps may be taken for its investigation.

### **VIII.—Weeds.**

The common field-weeds are shallow-rooted plants that are adequately kept under control by the ordinary operations of tillage, while many of those that grow during the rains are used as vegetables or as food for cattle. They may however reduce the kharif yield in seasons when continuous wet weather delays weeding; and in the lowlands they occasionally grow to such an extent on fallow land that the country plough

cannot be effectively worked when it is time to prepare the rabi seed-bed. In this last case an iron plough or some other cultivating implement is a great boon, and in any case the use of better implements in these tracts will give better tillage in the limited time available.

Only two weeds, *kans* and *baisurai* are known to establish themselves permanently to an extent that interferes with cultivation : but there are probably a few other grasses which behave in the same way as *kans* over limited areas.

*Kans*.—This grass is to be seen in occasional plants or small patches over a large part of the country ; but where cultivation is close and weeding is regularly done it has no chance of spreading to a dangerous extent ; its opportunity comes when land is left uncultivated. The plant then establishes itself with a very deep and complex root-system, and the patches spread rapidly, until the ordinary country plough cannot work owing to the obstacles presented by the roots. The land then remains uncultivated until the *kans* wears out.

*Kans* is a danger in the light soils of the middle doab, where it has in the past spread to a large extent over land that had become temporarily unproductive owing to a rise in the water-level. It is however most dangerous in Bundelkhand and in the mixed soils lying along the north of the Jumna in the lower part of its course : and speaking generally the richer the soil the greater is the danger.

The problem of exterminating it has not been fully solved, but it appears probable that a solution will be found in the adaptation of a tillage-implement to cut through the roots until the plant is destroyed ; and if this is found to be economically possible, there may be a useful field for advances to cultivators to enable them to clean their land.

The problem of preventing its extension is largely economic ; its spread is least where there is an adequate population with industrious habits and sufficient resources, and

## *Weeds.*

the general policy for the improvement of Bundelkhand aims at progress in this direction.

*Baisurai*.—This weed is found mainly in the middle doab from the Muttra district to Etawah ; but it also exists in Jaunpur, and possibly in other districts. It grows in the lighter soils and makes most of its growth in the hot weather when it sends down its roots to great depths. It thrives in dry seasons and is injured by a rise in the water-level. Tillage is not altogether prevented by the existence of this weed on the land, but the yield of crops is materially reduced. The plant has no economic value in ordinary seasons, but can be used to supplement the stock of fodder when this is very scanty ; attempts to make a palatable silage from it have not as yet been successful.

The best course to eradicate the weed is to plough the land with a soil-inverting plough between February and May, and again at the beginning of the rains. This checks the growth of the weed, enables the crop sown to get a good start, and gives it a chance of smothering the weed. Action is however required for several seasons to secure eradication : the more frequently ploughing is done in the hot weather, the shorter will be the period required.

The weed is certainly extending by the natural distribution of its seed : and there is some reason to think that it is carried by the canals. Extension will be prevented if the formation of seed is checked, and this would result from the measures indicated above for extermination. It would also be very largely prevented if the people would cut the surface-growth of the weed in the hot weather before it flowers, instead of at the beginning of the rains when the seed has been distributed.

### **IX.—Cattle-supply.**

The supply of cattle is dealt with in the note on the cattle survey.



### *Seed-supply.*

The action required regarding cattle-disease has been indicated in the district notes.

Speaking generally, it is desirable that the district staff should pay more attention to questions affecting the supply of cattle than has been usual in the past : the prompt suppression of disease and the provision of the capital required to replace losses from disease or other causes are matters for executive action, while knowledge of the leading breeders, where they exist, will often make it possible to remove or mitigate some of the obstacles that stand in their way.

#### **X. —Seed-supply.**

Cultivators experience considerable difficulties in obtaining sound seed when the produce of the previous year has been poor in quality, and a deterioration in cropping may result from this cause : for instance when wheat has been seriously affected by rust, the following rabi will probably show a lower percentage of wheat and a larger proportion of inferior mixed crops. It is desirable that when seed-time is coming on district officers should interest themselves in the position, and should make arrangements to provide advances for the purchase of seed whenever they have reason to think that the supply is defective.

In most parts of the provinces the provision of capital should be sufficient to meet the situation, but from time to time cases may arise where the trade will not supply sound seed even if cultivators have the money to pay for it ; and the probability of such an emergency should be reported to the agricultural department at the earliest possible moment, in order that a supply may be organised. When this is done, the seed can be advanced as *takavi* at whatever price may be determined, and no money need pass.

Similarly an early report should be made of any case in which it is found that cultivators want to change the local varieties of any particular crop. Cases of this kind have

### *Implements and machinery.*

arisen in connection with sugarcane and potatoes, and are more likely to occur in connection with crops that are raised from cuttings or tubers. The cost of importing cuttings or tubers in bulk is often very heavy, particularly in the case of sugarcane when quick transit is essential, and it may be desirable to arrange for growing at first only a small area, the produce of which shall be reserved for planting in the second season : for instance a bigha of sugarcane will give cuttings for planting 20 bighas or more in the second, and for 400 bighas or more in the third year. Arrangements on these lines require co-operation among individual growers, and an existing co-operative society will usually be the best agency for making a start.

### **XI.—Implements and machinery.**

The *takavi*-system can in many cases be so used as to facilitate the introduction of improved implements and simple machinery, the need for which increases with the cost of labour and cattle-power. The matter is simple when an applicant produces a recommendation from an officer of the agricultural department, because it may then be assumed that what he wants to buy will be suitable to his needs ; and the only questions for the revenue authorities will be the sufficiency of the security offered and the instalments for repayment. When however the applicant has no recommendation, it is desirable in the present state of the trade to take some precautions against imposture, except in the case of an implement or machine which has already been used successfully in the district. The simplest course will usually be either to refer the application to the agricultural department, or to require the applicant to obtain a letter of recommendation before the loan is sanctioned, but allowance must be made for the position and capacity of individual applicants, some of whom may be quite competent to decide for themselves, while others may probably be in the hands of unscrupulous agents.

## *Manures.*

Precautions are particularly necessary at present because a bad implement or machine will produce a prejudice against all implements or machines of the same kind.

When a loan is granted for machinery to be driven by mechanical power, the rules regarding inspection of boilers should be explained to the applicant.

## **XII.—Manures.**

As has often been pointed out, the most hopeful line of action for making a start to improve the manure-supply is to promote the use of other forms of fuel in the cities and towns. So far as wood is concerned, the decision recently taken to endeavour to establish plantations on some of the inferior land in the plains is a step forward: as regards coal and oil their use should be popularised by local exhibitions and demonstrations, and in such other ways as may be possible. In a social change of the kind Government can do comparatively little, but the following suggestions are put forward.

(a) The buildings maintained by the Public Works department at stations where coal is procurable should be fitted with suitable grates, instead of the open hearths on which wood is burnt. The use of coal would thus become familiar to clerks and servants.

(b) The railway might undertake the retail sale of coal and coke at goods stations while the demand is small. It must be remembered that the retail coal trade is only just coming into existence, and for the present can only serve a few of the largest towns; and coal can never become popular in a town unless it can be bought retail on the spot. It is understood that those English railways which sell coal retail at the country stations make a fair profit, though recent information on this point is not available; and expenditure in building up a trade would be justifiable in view of the increased business that would come to the railways.

## Communications.

(c) Arrangements might possibly be made with the leading firms in the oil-trade to stock suitable oil-stoves and oil-cookers at their numerous retail dépôts, and to endeavour to promote their sale. In England gas-companies have found a similar practice highly successful in stimulating consumption.

When it is proposed to change the sanitary system of a town, early information should be given to the agricultural department. The construction of a system of sewers, or some similar change may involve market gardeners and potato-growers in great difficulties, and the agricultural department will often be able to assist them by organising the supply of some suitable fertiliser to replace the sewage on which they have hitherto depended.

### XIII.—Communications.

The cultivator requires means of access to markets within easy reach of the railway; and the following remarks indicate some of his needs in detail.

(The individual cultivator in the plains (excluding Bundelkhand) is not specially anxious for a completely metalled road; he wants primarily a level road with no serious obstacles to the passage of his cart. In some places he objects to *kankar* metalling, and still more to stone, because of its severity on the feet of his unshod cattle: and where a road is metalled it is desirable to have *patris* of sufficient width to accommodate carts.

Steep gradients are the most objectionable feature of a road, because the practice of the country is to load carts fully for the level; a steep declivity leads to accidents, and a steep ascent involves overstrain on the cattle as well as a good deal of cruelty. Steep gradients are very commonly found at small bridges or culverts, and at fords or descents into river-valleys, and the improvement of these is most desirable; while the point should always receive attention in planning new bridges, particularly railway over-bridges where the road has to be carried to a considerable height. From this point of view

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the bridging of the streams and minor rivers is particularly desirable, because the fords are in many cases reached by very steep descents. Steep gradients should equally be avoided at the points where minor roads and tracks join an embanked main road.

As regards the surface of an unmetalled road, the cultivator wants it to be smooth and firm but not so firm as to get puddled in wet weather. Approximation to these requirements depends partly on construction and partly on maintenance. Where a road passes through loam and does not cross the natural flow of drainage, any pronounced elevation above the surface of the country is a mistake: the road should be very slightly convex in cross-section, earth for construction and repairs being taken from the sides and placed in the centre, thus giving shallow side-drains. On the other hand the road must not be allowed to fall below the level of the country and special repairs may be necessary from time to time to bring it up to its original level. Where however the road cuts across the natural flow of drainage, it must be embanked and adequate waterways provided: the extra cost of such a road makes it desirable to follow the watershed as closely as possible.

Where the road crosses a depression in which water may collect during the rains, it must be embanked sufficiently to avoid flooding: in this case the maintenance of the greatest possible width is desirable, and the widening of embanked roads may sometimes be a useful form of relief work.

When the road runs in loose sand, the maintenance of a firm surface is impossible: embanking does no good unless there is clay or loam just below the surface which can be used for the embankment; and it is best to metal the worst sandy stretches even when the rest of the road is unmetalled\*.

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\* It may be suggested that the classification of roads as metalled, or raised, or unraised may mislead district boards: the road should be adapted to the soil over which it passes, and where complete metalling is impossible a good road may be maintained partly metalled, partly raised, and partly unraised.

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The preservation and maintenance of the village tracks by which cultivators reach the regular roads must depend on the landholders until the financial resources of the local authorities can be very greatly increased; their chief safeguard for the present must be looked for in the gradual growth of public opinion. So long as most cultivators have to pass over these tracks in order to reach a road, it seems unlikely that the country-cart can be replaced by a lighter type.

As regards bridges on local roads, very large numbers of which are required, the difficulty is the large initial cost of a permanent masonry or iron structure. Where the need is urgent and funds are limited, district boards might be well advised to consider the expediency of constructing a temporary bridge (probably on a pile-foundation); it is believed that such bridges can be made to last for a considerable number of years, and they may contribute materially to the progress of agriculture.

The second side of the question is the connection of markets with the railway. Where the traffic is sufficient, this is obviously best secured by branch lines, or by some system of mechanical transport; it is much to be desired that the railway-administrations should experiment freely with all such systems as appear to be suited to the country, and that district boards should co-operate by adapting their roads where necessary to the needs of the system selected. But there will probably always be markets where the traffic must be moved by bullock-carts, and it is desirable, now that the cost of cattle-power is rapidly growing, that the carting should be economically done. For this purpose the country cart is unsuitable, and facilities should be given for its replacement by a lighter build in towns and cities and also on roads from markets to goods stations where the carts have not to travel across country. Suitable types might be selected by the departments of industries and public works, and their

### *Communications.*

introduction could probably be facilitated by requiring Government contractors to use them as far as possible.

The improvement of communications is mainly a question of funds. Most district boards are now working up to programmes designed, so far as funds are available, to bring their facilities up to the level of the best equipped districts; but the existence of these programmes should not be allowed to obscure the fact that the equipment of even the best districts is inadequate, and that the standard requires to be steadily raised. In the interests of agriculture it is much to be desired that when surplus funds become available for non-recurring expenditure, a substantial share should be distributed to district boards to enable them to accelerate the execution of the works on their programmes, and to undertake new works when the existing programmes are completed. It may be pointed out that while metalled roads cost in maintenance from six to seven per cent. annually on the capital outlay, the cost of maintaining bridges is very much less, ranging from one-half to one-tenth or one per cent. or even less for the large bridges; bridges therefore are works peculiarly suitable for construction from special funds.)

W. H. MORELAND.





## DISTRICT NOTE.

### SHAHJAHANPUR.

#### Topography.

THE topography of the district, which is by no means simple, is clearly brought out in the classification by circles and sub-circles made in the last settlement, which should be studied with the aid of the maps in the pargana handbooks. There are nine principal tracts which may be described as follows, beginning on the south-west, where the Ganges touches the district.

(1) *The Ganges tract*.—This small tract includes 18 villages, forming the Ganges sub-circle of the Bankati circle in pargana Jalalabad. The soil is either sand or light loam, and is exposed to the river floods which rarely bring fertilizing silt. Cultivation extends in dry years and contracts in wet.

(2) *The Bankati*.—This tract comprises 122 villages, that is the whole Bankati circle exclusive of the Ganges tract. It is a hard clay plain, still containing much jungle; the soil is poor, and requires a great quantity of moisture, while it dries quickly, the worst of it grows nothing but rice. Irrigation is essential for the rabi. Wells can seldom be made, and water is obtained by damming the streams at the end of the rains, the water being conducted through an indigenous system of canals. The supply is never excessive and is always liable to run short: when this happens the villages near the larger nalas are fairly protected while the rest are liable to suffer acutely if the rainfall is deficient or ill-timed. Communications are bad: roads are few and much cut up by nalas, and almost the whole tract may be under water during the rains. Rice is much the most important kharif crop, and it may be injured either by deficient rain or by

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floods ; in the rabi wheat and opium are the principal crops, and both require much water.

(3) *The Ram Ganga tarai.*—This tract lies along the Ram Ganga, and its composition is shown on the margin.

Pargana.	Circle.	Sub-circle.	Number of	The basin of
Jalalabad ...	Tarai ...	All except	villages.	the river is
		Umarsenda...	173	about five miles
Khera Bajhera	Ram Ganga	All Umarsenda	73	

broad, and the river shifts freely from one part to another, besides flooding the low-lying parts of the tract ; the floods are too swift to suit rice. The soil varies from good loam to sand, and is frequently renewed by the valuable silt of the river, which ; however, sometimes deposits only coarse sand. Irrigation is hardly necessary, as the soil retains moisture well, but it is useful if the season is at all dry ; temporary wells can be made, and a supply of water is also obtained from the old river channels. The kharif is so liable to injury from the river that the rabi (though not exceeding it in area) is much the more important crop. The tract does best when the rains are somewhat below the average and there are light falls in December or January.

(4) *Bahgul tract.*—This tract includes the villages influenced by the Bahgul, a river which enters the district slightly to the west of Miranpur Katra, and joins the Ram Ganga :

Pargana.	Circle.	Sub-circle.	Number of	it is made up
			villages.	of the sub-
Jalalabad ...	Tarai ...	Umarsenda	6	circles noted
Khera Bajhera	} Bhagul..	All	44	on the margin
Jalalpur ...			30	

together with part of the small pargana of Miranpur Katra (which was not sub-divided for assessment). This tract is inferior to the Ram Ganga tarai : the soil in Khera Bajhera is frequently hard clay, difficult to plough and more or less resembling the clay of the Bankati ; the rest is as a rule poor loam. The river floods are less rapid and less extensive than those of the Ram Ganga and rice is much more commonly

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grown; but they do not bring silt of any value. Wells are not generally easy to make, especially in the clay, where they are most needed, and the supply in them is often very inadequate. The Bahgul is dammed in places, but sometimes disputes or other causes prevent the construction of the dams, and then there is apt to be considerable loss from want of water.

(5) *The central bhur.*—This is an extensive stretch of light soil lying roughly between the Bahgul and Ram Ganga on the south-west and the Garrai on the north-east. It com-

Pargana.	Circle.	Sub-circle.	Number of villages.	prises the sub-circles shown
Kant	... Kant	... All except Garrai tarai	... 174	on the margin,
Jalalabad	... Bhur	.. { Chauki	... 14	and also a
		{ Jalalabad town	... 7	small portion
		{ Rest	... 59	of Miranpur
Khera Bajhera } Tilhar.	{ Bhur	.. All	... { 28 118	

Katra; but the Chauki and Jalalabad town sub-circles differ from the rest of the tract. The soil is generally sandy varying from light loam to *bhur*; the surface is flat with undulations in the more sandy places, here and there a few sand hills. As regards irrigation the settlement officer, writing of pargana Kant, says: "The circle requires as much irrigation as it can get. The soil does not require much water, but almost every field requires some or would be the better for some; and every field cannot be irrigated. The irrigated area seems to vary with the temporary prosperity or poverty of the people: irrigation involves hired labour, and often more than the *asamis* are able to afford." Water is obtained chiefly from small temporary wells worked by lever, which yield slowly and are soon exhausted. The main crops are *bajra* and wheat, the latter being of medium quality.

The Chauki sub-circle is an inferior tract and suffers in many places from water-logging. The Jalalabad town sub-circle consists of the highly-cultivated villages round the town, and may be classed as *st ble*.

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(6) *The central clay.*—This tract comprises (roughly speaking) the lower doab between the Garra and Garrai, and also a stretch of clay north of the former stream. The sub-

Pargana.	Circle.	Sub-circle.	Number of villages.	circles composing it are shown in the margin. The soil in this
Jamaur	... Jamaur	... All except Pasgawan	83	
Kant	... Kant	... Garrai tarai	43	
Nigohi	.. Khaimua	... All	51	

tract lies low and consists chiefly of very stiff and hard clay, which cannot be worked when dry and which dries very quickly. It requires much heavier rainfall than the lighter soils of the district, and irrigation for the rabi is essential: any serious deficiency in the rains is therefore disastrous. Wells cannot as a rule be sunk in the clay, but they are possible where the soil is lighter. Though low-lying, the tract does not appear to suffer from excessive rain.

(7) *The central loam.*—This is a large tract, continuous except where it is pierced by the Khaimua circle of pargana Nigohi (mentioned above.) It is composed of the sub-circles

Pargana.	Circle.	Sub-Circle.	Number of villages.	shown in the margin; those sub-circles which require separate description are marked with an asterisk; a part of Miranpur Katra may also be classed
Shahjahanpur	... Shahjahanpur	{ Khanaut*	21	
		{ Simrai	16	
		{ Sukheta*	17	
		{ Rest ...	139	
Jamaur	... Jamaur	... Pasgawan	44	
Tilhar	... Garra tarai	...	93	
Jalalpur	... Garra	...	82	
Nigohi	... Dumat	... { All ... }	101	
Baragaon	... Baragaon	...	125	
Pawayan	{ Gola*	...	62	
	{ Pawayan	...	96	
	{ Nahil	... Central ...	41	

with this tract. The main tract consists of fairly good loam, on the whole rather light. The cultivation is stable, and not liable to any special calamity: temporary wells can be made nearly everywhere. The Garra does not do great harm and its silt is fertilising; the floods on the Khanaut are more

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violent and do considerable injury to a limited area. This tract produces a great deal of sugarcane as well as other high-class crops. There appears to be little danger of over-saturation apart from the sub-circles marked with an asterisk.

The characteristics of these special sub-circles are as follows:—

- (a) *The Khanaut valley.*—The valey itself is subject to heavy floods in wet seasons, and the kharif is very precarious, while the rabi sowings may be delayed or even prevented. If the rainfall is light, there is good sugarcane and excellent rabi. The slopes are poor sandy loam which gives indifferent crops.
- (b) *Sukheta valley.*—The soil along this stream is heavy and bad, and liable to suffer from water-logging in wet years. Drought has also serious results as the soil dries quickly. The climate is bad and tenants are hard to keep.
- (c) *The Simrai jhil.*—This resembles on the whole Sukheta valley: it is a natural depression with heavy soil that goes out of cultivation in wet years.
- (d) *The Gola circle.*—This lies on the Khanaut stream, and consists mostly of rather poor loam: irrigation is not plentiful and temporary wells can only be made in the west of the loam (or roughly rather less than one half of the tract). The Khanaut does a good deal of injury to the villages adjoining it.
- (8) *The northern bhur.*—This tract is made up of the

Pargana.	Circle.	Sub-circle	Number of villages.	sub-circles shown on the margin, but is not entirely homogeneous. The soil is generally light
Pawayan ...	Nahil ...	{ Kbanaut ...	25	
		{ Jungla ...	19	
	Samwat ...	{ Khanaut ...	33	
		{ Bhainsi ...	56	
	Tareona ...	{ Gumti ...	25	
		{ Banda ...	45	
Khutar ...	Wiran ...	{ Gularia ...	26	
		{ Jhukua ...	88	
		{ ...	...	

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and sandy, with a good deal of inferior *bhur*. Population is scanty, and irrigation is greatly deficient, though wells can be made here and there except in the worst villages. The tract deteriorates towards the north where the climate is worse, the drinking water is bad and the people are very poor. The following is a brief description of the special features of the different sub-circles:—

*Nahil-Khanaut*.—There is very little good land and irrigation is not plentiful though some water can be had in most villages.

*Nahil-Jungle*.—This circle, which lies in two blocks, is somewhat superior to the average of the tract, but there is much jungle, and the crops suffer from wild animals, while there is water-logging in parts.

*Samwat-Khanaut*.—This is about the average of the tract.

*Samwat Bhainsi*.—The soil is very inferior; wells are difficult to dig and yield badly. The drinking water is exceedingly bad and the people suffer from fever and other diseases: they are wretchedly poor.

*Tareona-Gumti*.—This resembles Bhainsi except that it is not specially unhealthy.

*Tareona-Banda*.—This is somewhat above the average as cultivation is very stable and there is good irrigation.

*Tareona-Gularia*.—This is fairly good country: wells are generally possible, and the cultivation is stable.

*Wiran-Jhukua*.—This is a wilderness of jungle and *bhur* lying on the left bank of the Gumti. The soil is wretched, irrigation is very scanty, wild animals do much harm, the drinking water is bad and the villages are liable to be almost depopulated by disease; consequently cultivation is fluctuating and precarious, carried out largely by tenants who live a long distance off.

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(9) *The northern loam.*—This tract includes most of pargana Khutar, the most northerly in the district, and is composed of the sub-circles shown on the margin. The two por-

Circle.	Sub-circle.	Number of villages.	tions of the Abad circle, (which are not contiguous)
Abad	Southern	... 52	are on the whole generally similar: the soil is fairly good loam, and is well
	Northern	... 18	
Wiran	Chandpur	... 37	
	Forest	... 62	

cultivated by a dense population. Temporary wells are generally possible, the northern block being slightly inferior in this respect. The Chandpur sub-circle is an extension of the Northern Abad sub-circle into what was formerly forest, and resembles it generally.

Most of the forest sub-circle is uncultivated: the climate is unhealthy: the soil is uniform loam of fair quality, but its value depends on its distance from the forest and comparative immunity from wild animals. Drought is not a serious danger as the climate is so moist that irrigation is hardly needed.

### Water-supply.

The conditions of the different tracts in regard to water-supply have been noted above. There is a considerable amount of irrigation from rivers and *jhils*, but the chief source is the temporary percolation-well. The villages where these can be readily made have been recorded in the well-survey: about 130 villages have been noted (mostly in pargana Nigohi, Tilhar, Jalalpur and Khera Bajhera) where masonry wells are believed to be possible and should be constructed; there are also numerous villages in the northern pargana, where masonry wells would be useful but cannot be made owing to the absence of foundation clay. The number of masonry wells in the district is very small, and nearly half of them are in the single pargana of Shahjahanpur: the people are not interested in the matter, and local information as to the presence or absence of foundation-clay is probably much less trustworthy than in the doab or South Oudh.

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### **Cattle-supply.**

In the three southern tahsils the stock of cows is proportionately very low and the quality poor. A few superior working cattle are imported from the Punjab and Rajputana, but the bulk of the imports come from Pilibhit, Kheri and Sitapur. Tahsil Pawayan contains a considerable breeding industry. There are some large herds, the owners of which take much care in providing suitable bulls. The cows are mainly of the *Ganjarhi* type, which is closely allied to the Kheri breeds but somewhat inferior to them: the bulls are either of the same type, carefully chosen for quality, or else Khairigarh or Parehar. Most of the large herds graze either in Nepal or in the Pilibhit jungles for the greater part of the year, but use the local jungles during the rains. Apart from the large herds, the stock of cows in the north of the tahsil is very large: the quality is inferior to those of the large herds and the breed more mixed. Suitable bulls for breeding are very scarce. The cows are usually grazed in the local jungles: at present there is no complaint of scarcity of pasture, but cultivation is extending, and it is possible that the small owners may find it difficult to maintain their stock in the near future.

The district is liable to all the common forms of cattle-disease. The attitude of the people towards the practice of inoculation is at present one of indifference.

### **Annals.**

The district has a record of severe distress from drought in 1803, 1837 and 1877: the injurious effects of the last continued for several years. The first report received from the district relates to 1894-5, the last and wettest of the series of wet years. In that year the Ganges and Bankati tracts, and the Ram Ganga *tarai* suffered from excessive floods, the whole country being described as one expanse of water, and both kharif and rabi were very seriously injured. In 1895 the Bankati and the central clay suffered severely from deficient rain: and the two northern tracts were affected by the



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same cause, as the kharif was only half a crop and the absence of winter rain caused the small rabi area of 1896 to be very poor. Test works were opened in Pawayan in May and attracted labour until August.

The rains of 1896 ceased prematurely in August and the kharif yielded less than half the normal outturn, while the ground was too dry for sowing until rain fell in November. The rabi of 1897 was poor, especially in tahsil Pawayan, the Bankati and the clay tracts. Distress was severe in these seasons: relief works attracted large numbers of labourers from October to March, but the numbers fell rapidly at harvest and did not increase seriously afterwards. Gratuitous relief continued until October.

In 1897 the Ram Ganga *tara*i suffered from exceptional floods. In the following year no injury was reported, but in 1899 the early cessation of the rains caused serious injury to rice in the clay tracts, the outturn being only about five annas: the rabi area of 1900 also fell off, but the produce was good. The next year was prosperous; but in 1902 the yearly cessation of the rains again injured the kharif in the Bankati tract.

The seasonal yields since 1903 are given in the following table:—

Year.	Rabi.				Kharif.			
	All crops.	Wheat.	Barley.	Gram	All crops.	Rice.	Bajra.	Sugarcane.
1903	75	75	81	69	61	62	62	75
1904	85	87	87	85	81	84	84	87
1905	63	62	70	75	82	75	94	69
1906	80	81	81	75	110	119	116	100
1907	67	56	87	81	34	25	48	45
1908	81	87	94	50	79	56	100	62
1909	47	44	62	87	85	75	100	81
1910	95	94	94	100	94	100	87	94
1911	113	106	122	125	...	...	...	...

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The winter rains of 1903 were deficient and some injury was caused by strong winds : the area irrigated from wells in this year was remarkably high. The monsoon was a month late and the kharif area was seriously reduced while sugarcane suffered : heavy rain in October caused severe injury. A full rabi was sown for 1904, when the winter rains were light. The rains of this year were on the whole favourable, but were not sufficient in September, and the rabi of 1905 was somewhat reduced in area. The exceptional frosts in the spring caused serious injury, chiefly in the *bhur* tracts and river valleys. The rains of this year were delayed, and sugarcane suffered : there was some anxiety, which was relieved by rain at the end of September. The rabi area of 1906 was again contracted and the crops suffered from lack of moisture until good rain fell in February. The monsoon of this year was excellent, securing very fine kharif crops and a full rabi area for 1907 : this crop however suffered from drought in January and excessive rain in February and March, leading to severe rust on wheat.

The monsoon of 1907 lasted from 20th July to the end of August, in the interval there were heavy falls, unequally distributed. The clay and Bankati tracts suffered very severely the central *bhur*, where the rain was heavy, gave fair crops and was fit to sow with rabi. The rabi area of 1908 was however seriously contracted in the greater part of the district and the crops were weak owing to want of moisture in the early stages. Distress was not serious during these seasons, and it was noticed that the resisting-power of the people was very much greater than in the previous famine : gratuitous relief was given from January to June and a small amount of employment provided on aided works. Fodder was very scarce in the Bankati tract, where hay imported from the forest proved very valuable.

The rains of 1908 were favourable until the end of August, but deficient in September. Rice suffered severely

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and also sugarcane which had already been affected by drought in the spring. The ground was dry when seed-time came for the rabi of 1909, and the very severe outbreak of malaria hampered field-work so that the area sown was again very low. Winter rains were very deficient and the crops suffered throughout from lack of moisture, as well as from hail in February and heavy storms at harvest-time. The report this year mentioned that new settlers were arriving along the Gumti.

The rains of 1909 were on the whole heavy and there were severe floods in the lowlands: but a break in August lasted long enough to injure the rice-crop. The rabi area of 1910 showed a substantial increase though it was not up to the standard: the season was favourable as was the following kharif, though in this case *juar* was injured by borers. The rabi of 1911 was sown on a very large area as the result of heavy rain in October and yielded excellently: wheat was inferior to other crops owing to a slight outbreak of rust.

### Progress.

The cropped area shows some expansion in the last two decades, mainly in the northern tracts where new land has been cleared: the figures show an extension in the centre also but this is rather a recovery as cultivation had fallen off. The proportion of the area devoted to remunerative crops rose sharply during the period covered by the settlement proceedings, but has remained approximately constant for the last decade. The great increase was in wheat: sugarcane has fallen off substantially, and cotton (which is little grown) has not expanded. Poppy extended until 1907, but is now being reduced: potatoes have become of some importance.

The resources of the district in regard to irrigation have not increased materially. The number of masonry wells has increased by 64 per cent. since 1905, but is still almost negligible, there being only one such well to 666 acres of normal cultivation: and there are few signs of their construction

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becoming popular. On the other hand, there appears to have been a distinct advance in the recognition of the possibilities of temporary wells, and of the need for very liberal provision of capital for this purpose.

The population rose very slightly between 1891 and 1901 and more rapidly in the last decade; in 1911 it stood at 946,000 as against 919,000 in 1891.

Rural wages have risen somewhat in the last five years; in 1911 the rates recorded lay between 2 and 2½ annas.

As might be expected from the conditions of irrigation, loans for land-improvement were practically never taken until 1907-8. A large sum was given in that year, but the demand has not been maintained. Advances for temporary needs were also formerly little taken, but in the same year very large sums were given with advantage. There has as yet been no development of agricultural co-operation in the district.

The last two decades have seen the opening of the Pawayan steam tramway, the narrow gauge line from Shahjahanpur to Pilibhit, and the broad gauge line to Sitapur. When the sanctioned line from Tilhar to Budaun is opened the railway-system of the district will be practically complete. There has been no material extension of metalled roads in the same period: the chief need of the district appears to be for bridges.

The level of rents in the district is low. The rents of occupancy tenants recorded after the settlement in 1902 gave a rate of Rs. 3·5 per acre, and this has remained substantially unchanged. The average rate on other classes of land has risen in the same period from Rs. 3·5 to Rs. 4·0.

Local industries show a decline. Sugar-refining and weaving have been affected by competition, and the disappearance of indigo has involved the loss of some seasonal employment. Organized industry is represented only by the sugar factory and distillery at Rosa.

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Judged by the statistics of money-orders paid the district does not depend largely on external sources of income. The sums distributed about the year 1898 averaged about 6 lakhs annually : the present figure is about 8½ lakhs.

### **Dangere and possible remedies or improvements.**

1. The area sown with kharif crops depends mainly on the weather during the first month of the season counting from the first heavy fall of rain. An early beginning is an advantage, but the most important point is that there should be bright weather with just sufficient rain to enable tillage and sowing to proceed without interruption. If the first month is wet, sowings of dry crops will be reduced and rice will extend unless the rain is almost continuous ; while *bajra* will be sown later on if the weather clears.

The area under late rice depends to some extent on the same factor : if early rice has been contracted late rice will extend provided the weather in the second month is suitable. Frequent falls of rain with little sunshine produce an extension : and a long break at this time will reduce the area materially.

The area planted with sugarcane is influenced by the weather in February and March, at which time rain facilitates tillage : but it is determined mainly by economic causes. One of these is the yields and prices obtained from the crop in recent seasons ; another is the financial position of the cultivators, which depends mainly on the success or failure of the preceding harvests ; while in those localities where manufacturers give advances the views of the manufacturers as to the future are the controlling factor.

The small area sown with cotton is affected to some extent by the nature of the sowing season ; an early start and a dry season are favourable. The chief factors determining the area are the profit obtained in recent seasons, and the relative prices of cotton and food-grains.

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2. The yield of the early dry crops depends mainly on the weather during the first two months of the season : alternations of rain and bright weather are desirable, and the yield may be much reduced by excessive rain in the second month. The early rice requires more and later rain, and is not likely to give a full yield when the dry crops do best.

The late dry crops require the prolongation of the rains almost to the end of September : they may be seriously injured by heavy falls in the end of September or the beginning of October, while they will give very little grain if September is altogether dry.

The late rice requires more rain in September than is suitable for the dry crops, and at least one fall in October is desirable for its complete success.

The district relies too much for its food-supply on the prolongation of the rains through September ; the early dry crops are sown on a very small proportion of the area, and an extension of maize is desirable. The area under this crop fluctuates widely but is probably on the whole expanding.

Sugarcane is apt to suffer seriously at two periods. The first is the end of the hot weather : the crop benefits from an early commencement of the rains and suffers from delay. The second is the end of the rains : a premature cessation is most injurious, and rain in October is beneficial. The crop can stand a considerable excess of rain, but prolonged breaks are likely to cause injury.

Cotton is liable to considerable injury from excessive rain : the most dangerous times are probably just after sowing and again at the end of the season. It can withstand fairly long breaks when once it has made a fair start, and suffers from a dry September less than any other crop.

3. Apart from variations in the rainfall, the kharif is exposed to the following dangers :—

(a) *Floods*.—These may cause serious injury in the Ganges, Bankati, Ramganga and Bahgul tracts

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as well as in certain areas of the central loam enumerated in the section dealing with topography.

(b) *Insect pests.*—Both sugarcane and *juar* are liable to injury by boring-insects (vide Provincial Note, section VI). Other pests have not been recorded, but they should be watched for.

4. The rabi area depends mainly on the rainfall of September and early October. Good rain in the latter period brings the area substantially above the normal, while drought in September involves a large reduction.

In the tracts liable to flooding, the rabi area may be largely reduced if the floods occur late and leave the ground too wet for sowing.

5. Winter rains are very important for the rabi yield. They are beneficial up to about the middle of February (or later in the north), provided the falls are moderate and of short duration: rain late in the season will probably do some harm, while prolonged periods of damp and cloudy weather between January and March must be expected to result in rust on wheat and linseed. The loss from this cause may be serious, and its extent may not be fully realised till the crops are harvested.

When the ground has been dry at sowing time, and sowings have been largely made with irrigation, an early fall of winter rain is of great importance. When there is little winter rain or when falls are delayed, the crops fall off in condition as they ripen, and tend to wither under the strong dry winds which in such seasons must be expected in the spring. It is noteworthy that gram as a rule suffers most in this case: a seed-bed prepared with irrigation is less suitable for it than for the cereals or peas.

6. Frost occurring early in January does little harm except to *arhar* and possibly potatoes. Late frosts may injure the staple crops very severely; probably the danger is greatest

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in early February. Severe frosts may injure the vitality of the sugarcane reserved for seed.

Hailstorms early in the season are unimportant: the risk becomes serious when the crops are forming ears and increases as the season advances.

The rapeseed crop may suffer severely from the aphid if damp and cloudy weather occurs while the plants are in flower.

The poppy crop may suffer serious injury from damp and cloudy weather late in the season.

The potato-crop may be infected with the potato-moth, and vigorous action is desirable if this occurs (vide Provincial Note, section VI).

Whiteants occasionally do considerable harm to the young crops in the lighter soil when the seed-bed has been dry.

7. The area sown with *zaid* crops in ordinary seasons is small, and it does not extend greatly when stocks of food have been reduced.

8. A series of abnormal seasons of one type may produce certain cumulative effects. After some seasons of deficient rainfall the water-level falls, and the efficiency of temporary wells decreases, while the cost and labour of irrigation are materially enhanced.

On the other hand a series of wet years may raise the water-level to a point where the productivity of the land declines. This may happen almost throughout the district, but its effects will be most noticeable in the valleys of the larger rivers and in the lower parts of the central loam. The same process must be expected to lead to increased unhealthiness in the north of the district.

9. Distress requiring some measures of relief must be expected to occur in seasons when the rains have ceased at the beginning of September: probably the central loam



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and *bhur* will suffer least. The following measures were taken in 1907-8 when distress was slight :—

Revenue suspended, kharif	...	...	2 lakhs.
"    "    rabi	...	...	$\frac{1}{2}$ lakh.
"    remitted, kharif	...	...	$\frac{1}{2}$ "
"    "    rabi	...	...	nil.
Improvement loans	...	...	$\frac{1}{2}$ "
Advances for rabi	...	...	4 lakhs.
"    kharif	...	...	1 lakh.

Maximum proportion of population relieved 0·5 per cent. in February.

10. A serious shortage of fodder may occur in the Bankati and possibly in other parts of the south of the district in seasons when the rains have ceased so early that the crops wither altogether ; in this case the only remedy that can be suggested is the importation of grass from the Pilibhit forests and its distribution on the *takavi*-system. The demand will depend very largely on the winter rains : if there are none, it may become considerable, but even light falls bring up enough grass to keep large numbers of cattle going.

A fodder-famine does not necessarily occur when the large millets yield no grain, as the plants may have grown to a sufficient size to yield fodder ; but in such seasons *juar* occasionally becomes poisonous and the loss of cattle due to this cause may be considerable. The poison is formed under the abnormal conditions of growth, and its presence cannot be recognized beforehand except by analytical methods : the only action possible is to provide advances to enable cultivators to replace cattle that have died from this cause.

11. The improvement of the water-supply is not easy, and apparently no general measures are possible at present.

Loans for masonry wells should be given when required, and a boring-staff should be maintained to assist in locating sites. Should a practicable form of percolation-well be devised arrangements should be made for the construction of a sufficient number to serve as demonstrations.

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There is probably scope for the introduction of power-pumps on the minor streams.

12. There is at present no demand for drainage works, but a series of wet seasons may result in complaints from the areas in the central loam and northern *bhur* enumerated in the section dealing with topography.

13. To maintain the breeding industry, it is desirable that any action authorized by Government may be taken to preserve the existing grazing-grounds in the north of the district, and to improve the supply of bulls in the same region. Special care is also required to minimise losses from cattle-disease in this tract: the system of reporting outbreaks prescribed in the Land Records Manual should be strictly enforced, and the veterinary staff should be sufficient to localise outbreaks where they occur.

14. The district is not rich in agricultural capital: the supply furnished by the sugar-manufacturers is important, but it costs too much: and in the north the people are often very poor. Pending the possible development of a co-operative organisation, there is a considerable field for the *takavi*-system. Improvement loans should be given when required for masonry wells, or other valuable works: agricultural loans may be required in the following cases:—

- (a) *Early cessation of the rains.*—The demand for loans to sow the rabi may be very great, and special efforts will be required for rapid distribution; there may be a further demand for the following kharif, while money may be wanted about February to plant sugarcane, and possibly to sow *zaid* crops.
- (b) *Floods.*—Advances may be required in the flooded areas to enable cultivators to sow rabi.
- (c) *Cattle-disease.*—It is important that cultivators should be in a position to replace working-cattle by the beginning of the next tillage-season.

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(d) *Curtailement of the poppy area.*—It may be desirable to offer advances in villages where the crop has been largely grown to enable cultivators to substitute some other remunerative crop.

15. There is at present no agency to carry out agricultural improvements requiring associated action, nor can such an agency be suggested other than a co-operative organisation. The cropping of the district requires examination before definite suggestions can be made for its improvement; an extension of maize is desirable as a protection, and probably better varieties of sugarcane can be found for some localities. There is not much scope at present for expensive machinery other than pumping-plant, but improved tillage-implements should be gradually adopted, while special attention is required to the question of improving the efficiency of cane-mills.







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